

CLAIMS

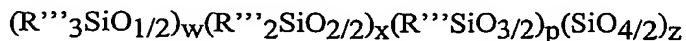
1. A method of forming a powder and/or discrete gel particles of a compound selected from the group of a metallic oxide, a metalloid oxide, a mixed oxide, an organometallic oxide, an organometalloid oxide, an organomixed oxide resin, and/or an organic resin from one or more respective organometallic precursor(s), organometalloid precursor(s) and/or organic precursors and mixtures thereof; comprising the steps of:
  - i) passing a gas into a means for forming excited and/or unstable gas species;
  - ii) treating said gas such that upon leaving said means the gas comprises excited and/or unstable gas species which are substantially free of electrical charges at a temperature of between 10°C and 500°C;
  - iii) introducing a gaseous and/or liquid precursor which has not been subjected to steps (i) and (ii) into said excited and unstable gas species in a downstream region external to the means for forming excited and/or unstable gas, interaction between said precursor and said excited and unstable gas species resulting in the formation of a powder and/or discrete gelled particles; and
  - iv) collecting resulting powder and/or discrete gelled particles.
2. A method in accordance with claim 1 wherein the means to generate excited and/or unstable gas species is an electrical discharge apparatus.
3. A method in accordance with claim 1 or 2 wherein the liquid precursor is treated by the excited and/or unstable gas species resulting therefrom, in a container.

4. A method in accordance with claim 3 wherein the container is a fluidised or circulating bed.
5. A method in accordance with claim 4 wherein the gas comprising excited and/or unstable gas species is utilised as the gas in the fluidised or circulating bed for suspending powders, discrete gel particles and/or droplets of liquid.
6. A method in accordance with any preceding claim wherein the liquid and/or gas precursor is in the form of a liquid compound, a solution of a high viscosity liquid or solid compound in either a liquid carrier or a liquid co-reactive and/or a molten solid.
7. A method in accordance with claim 6 wherein the liquid precursor is introduced into the excited and/or unstable gas species in the form of an atomised liquid.
8. A method in accordance with claim 7 wherein the atomised liquid is introduced into the excited and/or unstable gas species by direct injection.
9. A method in accordance with any one of claims 1 to 5 wherein the liquid and/or gas precursor is an organometallic compound of titanium, zirconium, iron, aluminium, indium and tin or mixtures containing one or more thereof.
10. A method in accordance with any one of claims 1 to 5 wherein the liquid and/or gas precursor is an organometalloid compound of germanium or silicon.
11. A method in accordance with claim 10 wherein the organometalloid compound is selected from an organosilane and an inorganic silane where the inorganic groups are selected from halogeno, hydrogeno, or hydroxyl groups, and mixtures thereof.

12. A method in accordance with claim 11 wherein the organosilane is a functionalised silane containing one or more organic groups selected from the following alkenyl, aryl, H, OH, amino groups, aldehyde groups alkyl halide groups, alkyne groups amido groups, carbamate groups, urethane groups, organic salts, carboxylic acid groups and their derivatives, heterorganic groups containing boron atoms and/or phosphorus atoms mercapto and sulphido groups; grafted or covalently bonded amino acids and/or their derivatives, grafted or covalently bonded proteins, enzymes and DNA.
13. A method in accordance with claim 10 wherein the organometalloid compound is an organopolysiloxane having a viscosity of from 0.65 to 1000 mPa.s.
14. A method in accordance with any one of claims 1 to 5 wherein the gaseous and/or liquid precursor is an organic compound or a mixture of organic compounds or a mixture of organic and organosilicon compounds.
15. A method in accordance with any preceding claim wherein subsequent to preparation said powder and/or discrete gelled particles are treated on one or more occasions with an excited and/or unstable gas species and/or one or more functionalising precursors.
16. A powder and/or discrete gel particles of a compound selected from the group of a metallic oxide, a metalloid oxide, a mixed oxide, an organometallic oxide, an organometalloid oxide, an organomixed oxide resin, and/or an organic resin, obtainable in accordance with the method in any preceding claims.
17. A powder and/or discrete gel particles in accordance with claim 16 having a particle size of from 1nm to 2000µm.

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18. A powder and/or discrete gel particles in accordance with claims 16 or 17 comprising an organosilicone resin having the following empirical formula:-



where each R''' is independently an alkyl, alkenyl, aryl, alcohol, H, OH, amino groups, aldehyde groups alkyl halide groups, alkyne groups amido groups, carbamate groups, urethane groups, biochemical groups, biochemical species organic salt based group, carboxylic acid groups and their derivatives such as acid anhydride groups, organic groups containing boron atoms and phosphorus and sulphur containing groups such as mercapto and sulphido groups.

and wherein

$$w + x + p + z = 1 \text{ and } w < 0.9, x < 0.9, p + z > 0.1.$$

19. A powder and/or discrete gel particles in accordance with claim 16 or 17 comprising an organic resin.
20. An apparatus for making powders or discrete gel particles by the method of claims 1 to 15 comprising a means for generating an excited and/or unstable gas species (1), a means adapted to introduce a gaseous and/or liquid precursor (50a, 50b) which has not been subjected to steps (i) and (ii) into said excited and unstable gas species in a downstream region 11 external to the means forming excited and/or unstable gas (1), and a means for collecting resulting powder and/or discrete gelled particles (52, 54).
21. An apparatus in accordance with claim 20 wherein said apparatus forms a part of a fluidised or circulating bed (20).

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22. An apparatus in accordance with claim 20 or 21 wherein the means adapted to introduce a gaseous and/or liquid precursor (50a, 50b) is an atomiser.
23. An apparatus in accordance with claim 20, 21 or 22 wherein the collection of the resulting powders and/or discrete gel particles is made by bringing them into contact with a liquid material thus providing a means of directly formulating the powder and/or discrete gel particles into products for specific applications
24. An apparatus in accordance with any one of claims 20, 21 or 22 wherein means for generating an excited and/or unstable gas species (1) is an electrical discharge assembly.
25. Use of a powder and/or discrete gel particles in accordance with any of claims 16 to 19 in optoelectronics, photonics, flexible electronics, optical devices, transparent electrically conductive films, displays and solar cells or as thermally conductive fillers, biotechnology, biosensors, detergents, filtration, and or separation applications.